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NOTES FROM PACIFIC COAST OBSERVATORIES

THE ORBIT AND SPECTRUM OF H. R. 8803

The variable radial velocity of H. R. 8803, ($\alpha = 23^h 03.0^m$; $\delta = +59° 13'$) was discovered by Dr. J. S. Plaskett from five spectrograms obtained at the Dominion Astrophysical Observatory at Victoria, B. C., between the dates August 22nd and September 15, 1918. The binary character of the star was announced by Dr. Plaskett and published in the *Jour. Roy. Astr. Soc., Canada* for November 1918. The writer secured eleven more spectrograms between August 14 and September 22, 1919 while at the Dominion Astrophysical Observatory during the summer of 1919. Thirteen more were secured by the writer and the members of the staff between August 4 and October 18, 1920. All of the twenty-nine

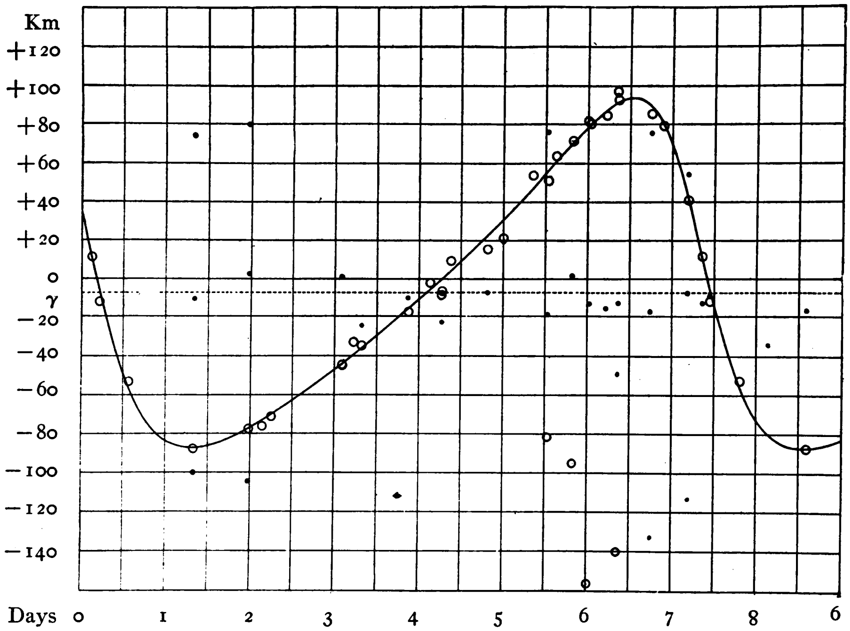

FIG. 1. Radial Velocity Curve for H. R. 8803 Showing Individual Observations.

⊙ Observed Velocities for all Lines Used Except Calcium, for Principal and Secondary Component.

● K-Line of Calcium, Observed Velocities.

spectrograms were measured by the writer with the exception of the first five, for which the measures made by Dr. Plaskett were used.

The spectrum is of type B3 with lines which are often faint or else rather diffuse, but, on the whole, not what might be regarded as difficult to measure. On four plates from two to three very weak lines of the secondary spectrum could be seen and these were measured. These measures of the secondary were not included in the least squares adjustment because they are so few and because being such very faint and difficult lines, their inclusion would not strengthen the solution. From the plotted positions of the observations for the secondary on the diagram of the velocity curves, as derived from the final elements, the mass of the secondary is judged to be about 4/5 of the mass of the primary.

From the preliminary elements, (see Table of Elements), observation equations were built up according to the notation of Lehman-Filhes and a least squares solution effected. Since the observations extended over parts of three seasons, the period was also included in the solution, which necessitated treating all the observations separately.

The solution of the normal equations gave corrections to the preliminary elements, as given in the Table of Elements.

Since the final ephemeris residuals agreed closely with those obtained by substitution in the observation equations, it was unnecessary to make more than one solution. The sum of the weighted squares of the residuals is reduced from 771 to 622 or nearly 20 per cent.

TABLE OF ELEMENTS

ELEMENT	PRELIMINARY	FINAL
Period P	7.250 days	7.25050 ± 0.00008 days
Eccentricity e	0.40	0.376 ± 0.005
Longitude of Apse ω	75°	71°.58 ± 2°.66
Velocity of System γ	—7.50 Km per sec.	—7.45 ± 0.02 Km per sec.
Semi-amplitude K	94.0 Km	90.54 ± 0.78 Km
Periastron passage T	J.D. 2,421,825.120	J.D. 2,421,825.038 ± 0.044 da.
Semi-major axis $a \sin i$		7,751,000 Km
Mass $(m_1+m_2) \sin^3 i$		0.3464 ⊙

A general idea of the precision of the measures may be obtained from an inspection of the radial velocity curve. The points indicated by open circles are individual observations obtained by averaging the velocities obtained from the measures of all lines, except the calcium lines. The probable error of a single observation is 2.60 Km.

THE CALCIUM LINES

Fifteen of the 29 spectrograms secured for this star show the K-line of calcium, and of these one plate also showed the H-line with sufficient clearness to make it possible to get a measure with reasonable certainty that it was not a blend with Hϵ. Plates 2811 and 2931 also show a second component for the K-line which gives evidence of being an oscillating K-line belonging to the principal component and numbers 4902, 5029, 5040 and 5220 show two additional components one on each side of the stationary component. These lines are always narrow and, while the stationary line is sometimes quite easy to measure, it is generally faint and the components are always faint. It is possible that a fault on the plate may have been measured in some cases instead of a line, or at least that the measures of a line may have been influenced by a fault near the line, but such cases must be rare, if indeed they occur at all. The measures of one of these oscillating lines agree as well as can be expected, for a weak, faint line, with the velocity curve for the principal component, and the other seems to be the K-line for the secondary component, at least measures of it agree as well as one could expect, for a weak faint line, with the probable velocity curve for the secondary component. This line is, if anything, the weakest of the three. The individual observations for the calcium lines are shown by small black dots on the diagram of the velocity curve. For the stationary line, the average velocity, −10.34 Km, agrees fairly well with the velocity of the system, this mean being the mean of all the lines listed as stationary with the exception of the one giving a velocity of −49.6. It is hard to explain this measure, unless a nearby fault influenced the result. At any rate, it was thought best not to include this observation in the mean.

So far as is known to the writer, the only other star which shows an oscillating K-line as well as the stationary K-line is *α Aquilae*[1]. In the case of *β Scorpii*[2] and *VV Orionis*[3] the one K-line visible oscillates but the amplitude of the oscillation is not so great as for the other lines.

This star is especially interesting because the oscillating line for both primary and secondary component show on at least four plates; the only other case of this of which the writer is aware being on plate No. 2099 listed by Gordon in Table 73 on page 195 of Vol. 3 of the Publications of the Allegheny Observatory.

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[1] *Publ. Allegheny Obs.* **3**, 189, 1916.
[2] *Publ. Allegheny Obs.* **2**, 138, 1912.
[3] *Publ. Allegheny Obs.* **3**, 186, 1915.

It is hoped that it will be possible to follow this very interesting star every few years to see if any systematic changes take place in the elements of its orbit and also to see if any changes occur in the character of the K-line.

I wish here to express again my appreciation of the kindness shown me by Dr. Plaskett and all the members of the staff of the Dominion Astrophysical Observatory for the assistance given me in prosecuting the work on this binary.

S. L. Boothroyd.

Univ. of Washington,
Seattle, Feb. 1, 1921.

The Silicon Line λ3906 in the Electric Furnace Spectrum

The occurrence of the silicon line λ3905.7 in certain types of stellar spectra made it desirable to examine this line at various temperatures of the electric furnace. A set of spectrograms was accordingly made with silicon metal in the vacuum furnace at temperatures ranging from 1700° to 2500° C for the emission spectrum, and 2400° to 2650° C for the absorption spectrum. The incandescent background for the latter was obtained by placing a graphite plug in the hottest portion of the tube.

With the open tube, a temperature of about 2000° C. was found necessary to produce the line. At higher temperatures it strengthened rapidly, but remained narrow with no apparent tendency to reverse. With a plug in the tube, the line was just visible in absorption at 2400°. This agrees with the initial appearance in emission at 2000°, since in this region of the spectrum it has been shown that the plug temperature must be about 400° higher than the temperature producing the same spectrum in emission. At 2650° the absorption line was fairly strong, but narrow.

No other silicon lines were given by the furnace in this region, but a gauge of the response of λ3906 to temperature is obtained by comparing it with the neighboring iron lines, due to impurities in the silicon. The melting point of silicon is 100° below that of iron, and both metals form carbides in the graphite tube. At 2000°, however, when λ3906 just appears, the whole low-temperature iron spectrum is well developed, and the Class III lines, belonging to the high-